

Exponential Equations

Name

1. In an experiment researchers found that a specific culture of bacteria increases in number according to the formula

$$N = 150 \times 2^t,$$

where N is the number of bacteria present and t is the number of hours since the experiment began.

Use this formula to calculate

- (a) the number of bacteria present at the start of the experiment;
- (b) the number of bacteria present after 3 hours;
- (c) the number of hours it would take for the number of bacteria to reach 19 200.

Working:

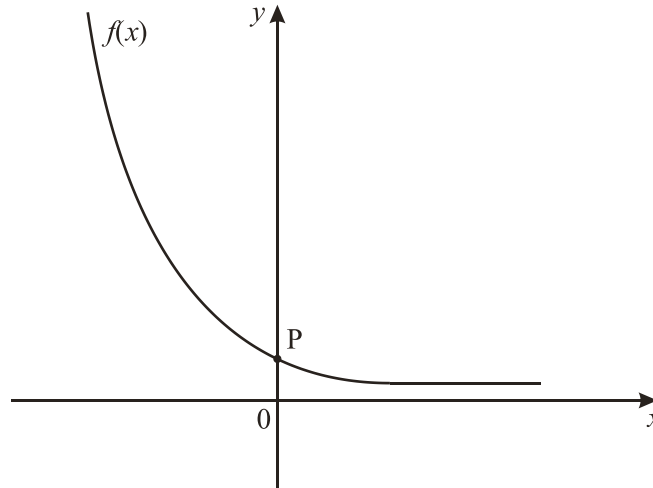
Answers:

- (a)
- (b)
- (c)

(Total 4 marks)

(Total 4 marks)

3. The following diagram shows part of the graph of an exponential function $f(x) = a^{-x}$, where $x \in \mathbb{R}$.



- (a) What is the range of f ?
- (b) Write down the coordinates of the point P.
- (c) What happens to the values of $f(x)$ as elements in its domain increase in value?

Working:

Answers:

- (a)
- (b)
- (b)

(Total 4 marks)

4. The number (n) of bacteria in a colony after h hours is given by the formula $n = 1200(3^{0.25h})$. Initially, there are 1200 bacteria in the colony.

- (a) Copy and complete the table below, which gives values of n and h .
Give your answers to the nearest hundred.

time in hours (h)	0	1	2	3	4
no. of bacteria (n)	1200		2100	2700	

(2)

- (b) On graph paper, draw the graph of the above function. Use a scale of 3 cm to represent 1 hour on the horizontal axis and 4 cm to represent 1000 bacteria on the vertical axis. Label the graph clearly.

(5)

- (c) Use your graph to answer each of the following, showing your method **clearly**.

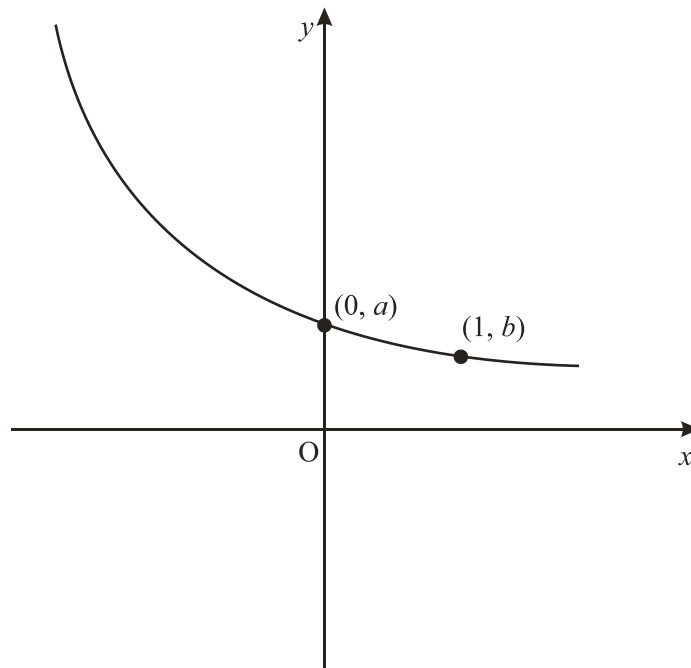
- (i) How many bacteria would there be after 2 hours and 40 minutes?
Give your answer to the nearest hundred bacteria.
- (ii) After how long will there be approximately 3000 bacteria? Give your answer to the nearest 10 minutes.

(4)

(Total 11 marks)

5. The following diagram shows the graph of $y = 3^{-x} + 2$. The curve passes through the points $(0, a)$ and $(1, b)$.

Diagram not to scale



- (a) Find the value of
- (i) a ;
 - (ii) b .
- (b) Write down the equation of the asymptote to this curve.

Working:

Answers:

- (a) (i)
- (ii)
- (b)

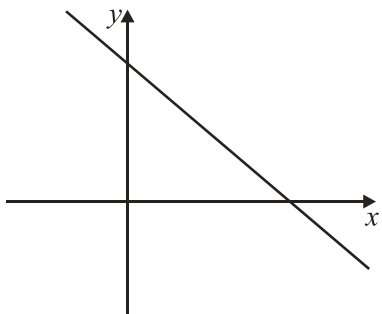
(Total 8 marks)

6. The diagrams below are sketches of some of the following functions.

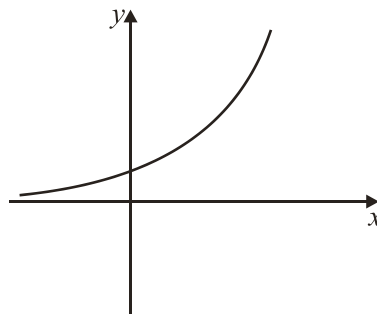
(i) $y = a^x$ (ii) $y = x^2 - a$ (iii) $y = a - x^2$

(iv) $y = a - x$ (v) $y = x - a$

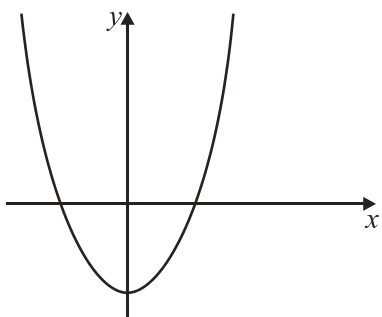
(a)



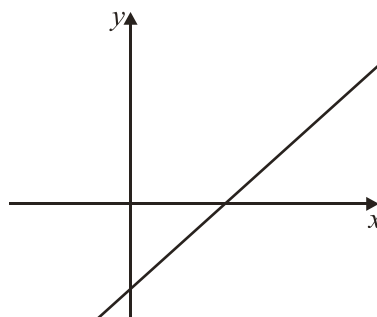
(b)



(c)



(d)



DIAGRAMS NOT TO SCALE

Complete the table to match each sketch to the correct function.

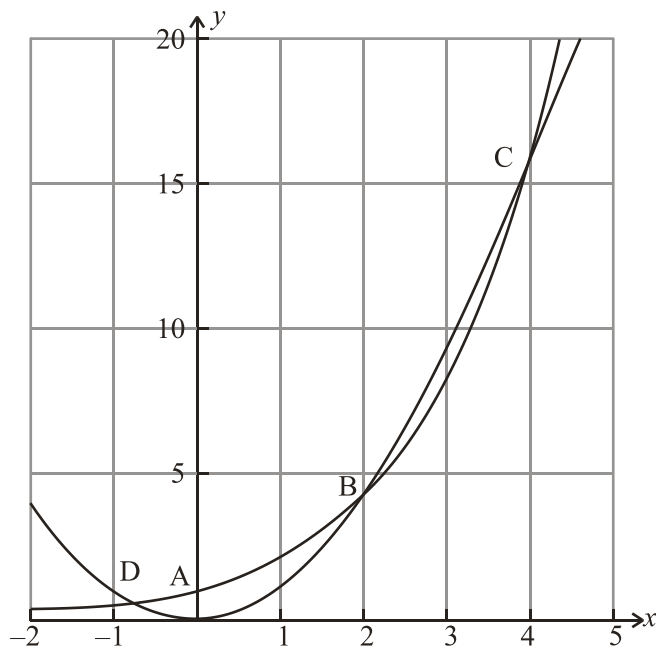
Sketch	Function
(a)	
(b)	
(c)	
(d)	

Working:

(Total 8 marks)

7. The figure below shows the graphs of the functions $y = x^2$ and $y = 2^x$ for values of x between -2 and 5 .

The points of intersection of the two curves are labelled as B, C and D.



- (a) Write down the coordinates of the point A. (2)
- (b) Write down the coordinates of the points B and C. (2)
- (c) Find the x -coordinate of the point D. (1)
- (d) Write down, using interval notation, all values of x for which $2^x \leq x^2$. (3)

(Total 8 marks)